DEVICE AND METHOD FOR IMPROVED LONG TERM SIGNAL ATTENUATION PERFORMANCE OF FIBER OPTIC CABLE AND APPARATUS INTERFACES

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EC Classification:
Equivalents:

Abstract

The present invention is directed is directed to a method and apparatus for improved long term signal attenuation performance of fiber optic cable and cable and/or fiber interface components. The improved long term signal attenuation performance of the fiber optic cable is achieved by introducing an additive that will occupy defect sites in the optical fibers, such as deuteruim, into materials used in the fiber optic cable, either prior to or during the assembly process. The fiber optic cable casing structure then acts as a reaction chamber so that the additive which has been introduced during the fiber optic cable assembly process will react with the optical fibers so as to occupy defect site locations in the optical fibers. for example, the reaction of silica defect sites with deuterium improves the long term stability of the attenuation characteristics of the fiber optic cables because the number of defect sites available for hydrogen molecules to react with are reduced. According to one exemplary embodiment of the invention deuterium is introduced into a fill material used in the fiber optic cable, further, the material into which deuterium is introduced may be an embedding material into which the optical fibers are embedded within the casing of the fiber optic cable. The deuterium may be introduced into the material by dissolving the deuterium into the material or bubbling the material with deuterium. In another exemplary embodiment of the invention, deuterium is introduced into a fiber optic apparatus housing, which contains fiber optic components, prior to sealing the housing. According to a still further exemplary embodiment of the invention, deuterium is introduced into the fiber optic cable by exposing the optical fibers to deuterium prior to assembling the optical fibers into a fiber optic cable. In any case, during the cabling process and over time the deuterium retained within the fiber optic cable will react and combine with the defect sites in the optical fibers so that hydrogen has a low probability of reacting at those same defect sites, thereby improving the long term stability of the attenuation characteristics of the optical fibers, fiber optic cable and/or optical fiber components housed within apparatus cases.

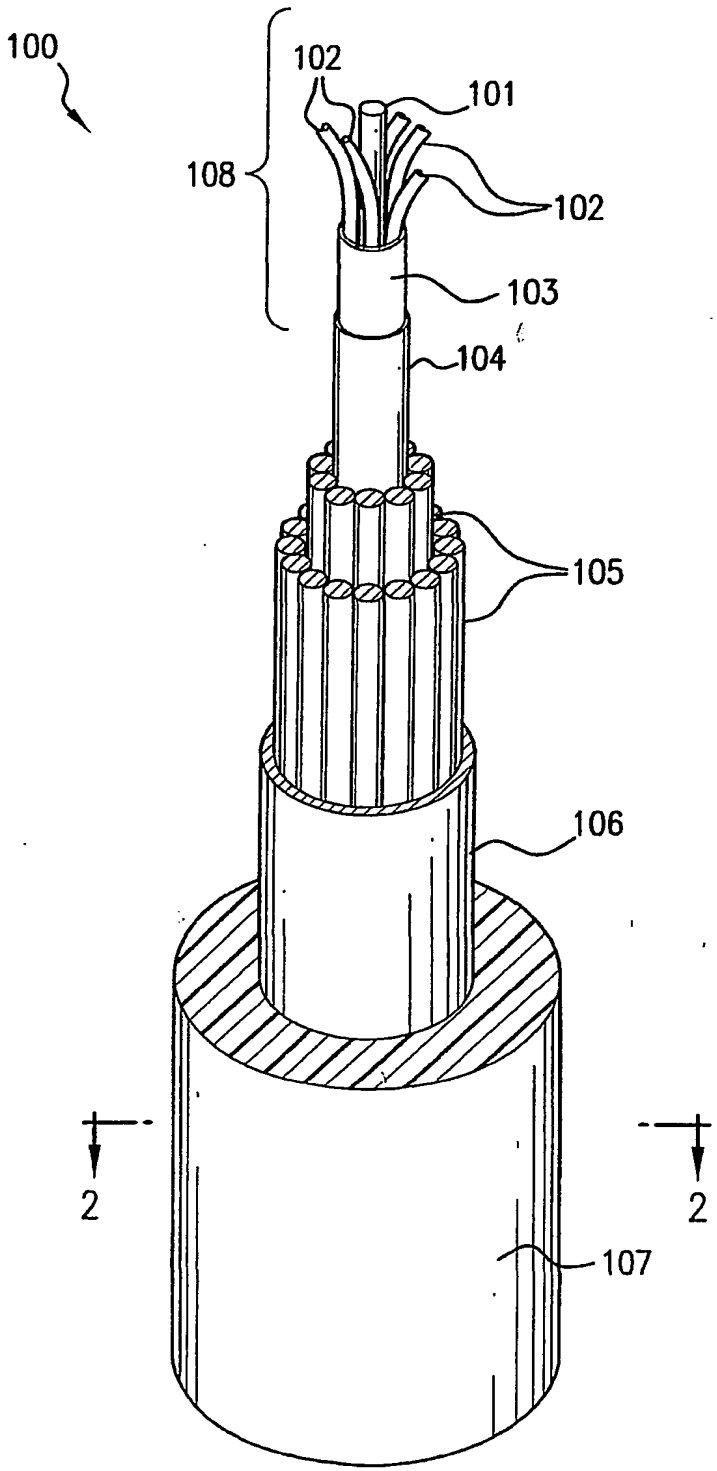


FIG.1

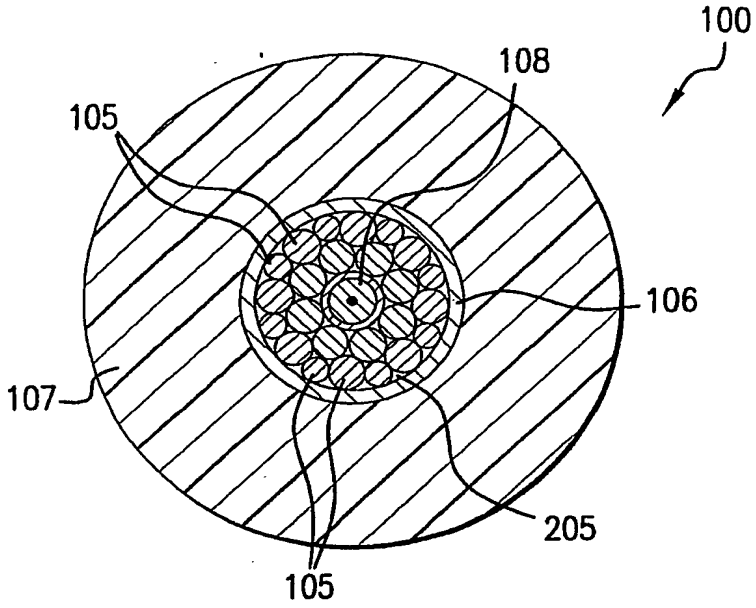


FIG.2

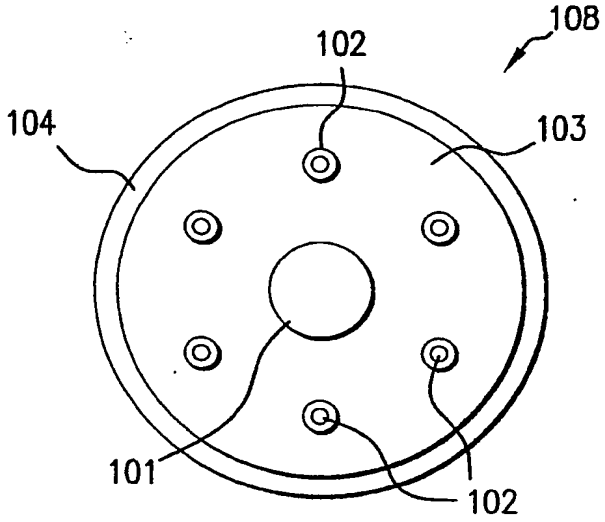


FIG.3

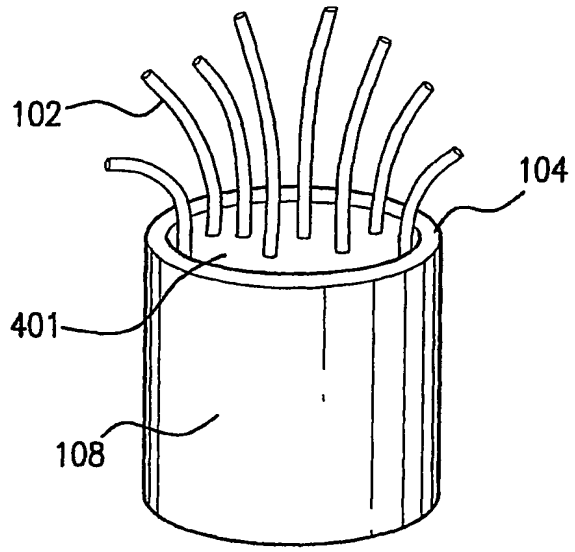


FIG.4

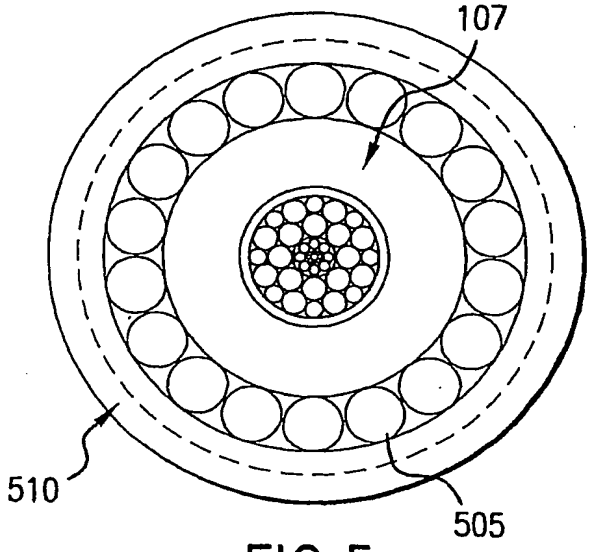


FIG.5

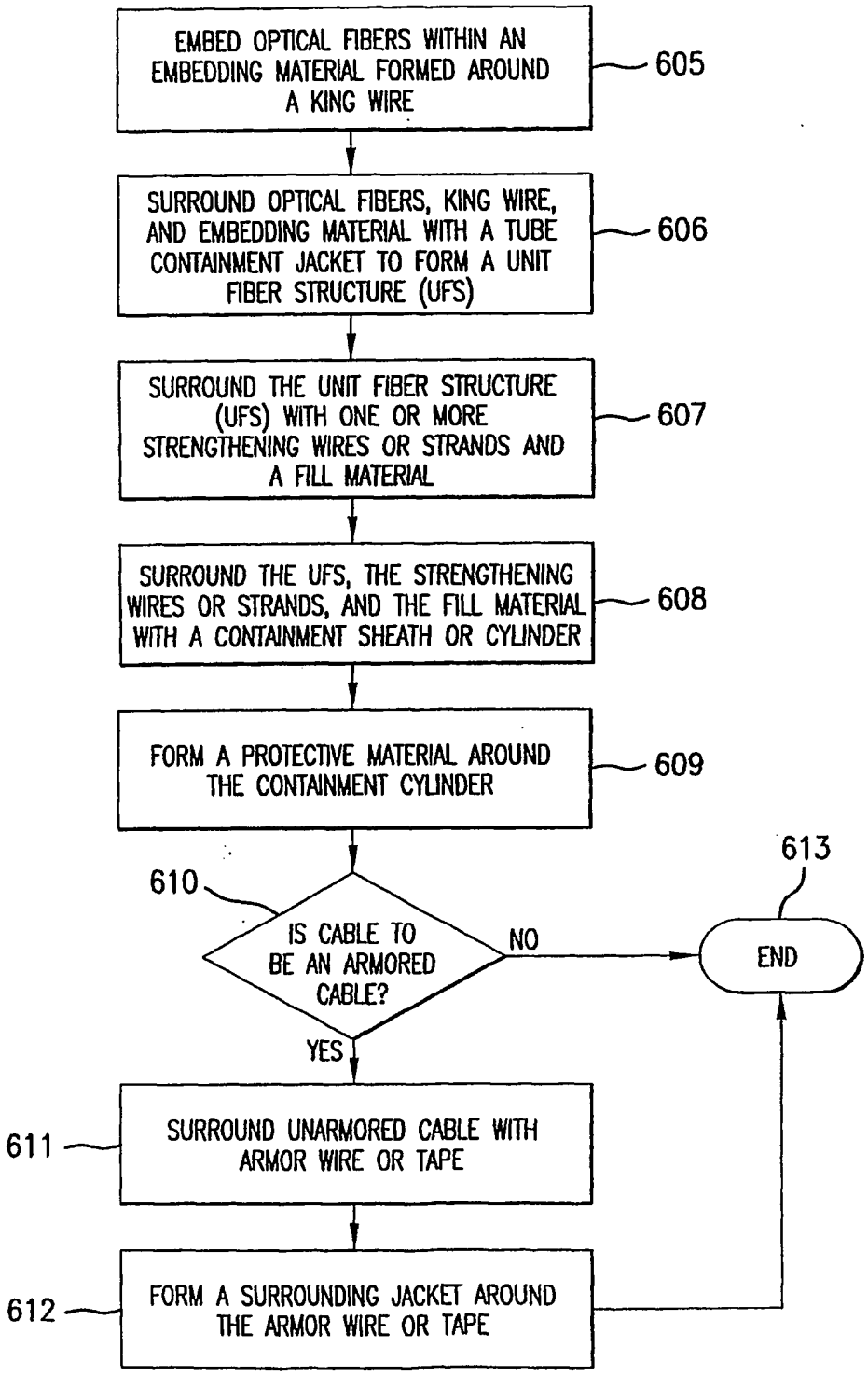

EMBED OPTICAL FIBERS WITHIN AN EMBEDDING MATERIAL FORMED AROUND A KING WIRE
605
SURROUND OPTICAL FIBERS, KING WIRE, AND EMBEDDING MATERIAL WITH A TUBE CONTAINMENT JACKET TO FORM A UNIT FIBER STRUCTURE (UFS)
606
SURROUND THE UNIT FIBER STRUCTURE (UFS) WITH ONE OR MORE STRENGTHENING WIRES OR STRANDS AND A FILL MATERIAL
607
SURROUND THE UFS, THE STRENGTHENING WIRES OR STRANDS, AND THE FILL MATERIAL WITH A CONTAINMENT SHEATH OR CYLINDER
608
FORM A PROTECTIVE MATERIAL AROUND THE CONTAINMENT CYLINDER
609
610
IS CABLE TO BE AN ARMORED CABLE?
NO
YES
613
END
611
SURROUND UNARMORED CABLE WITH ARMOR WIRE OR TAPE
612
FORM A SURROUNDING JACKET AROUND THE ARMOR WIRE OR TAPE

FIG.6

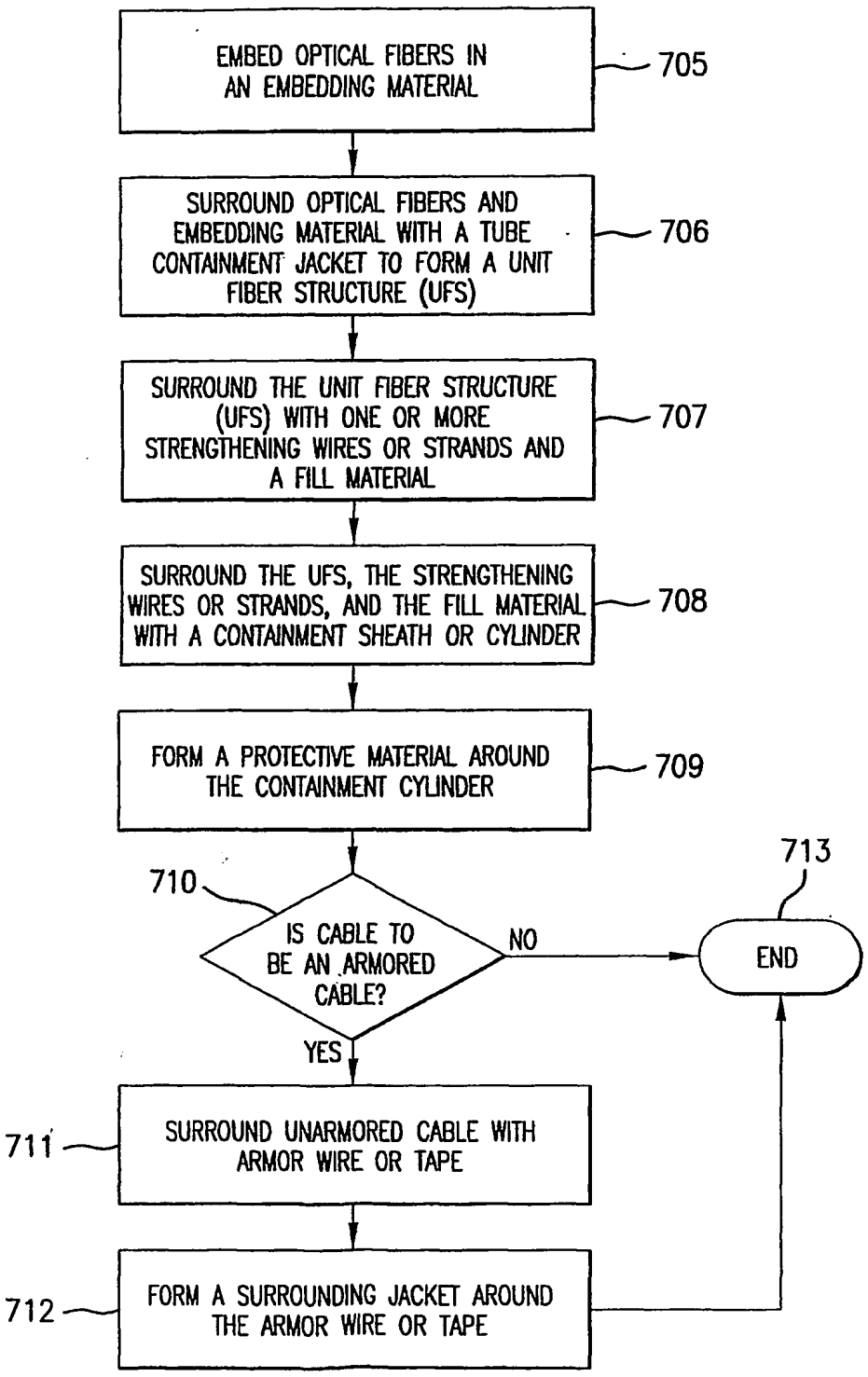
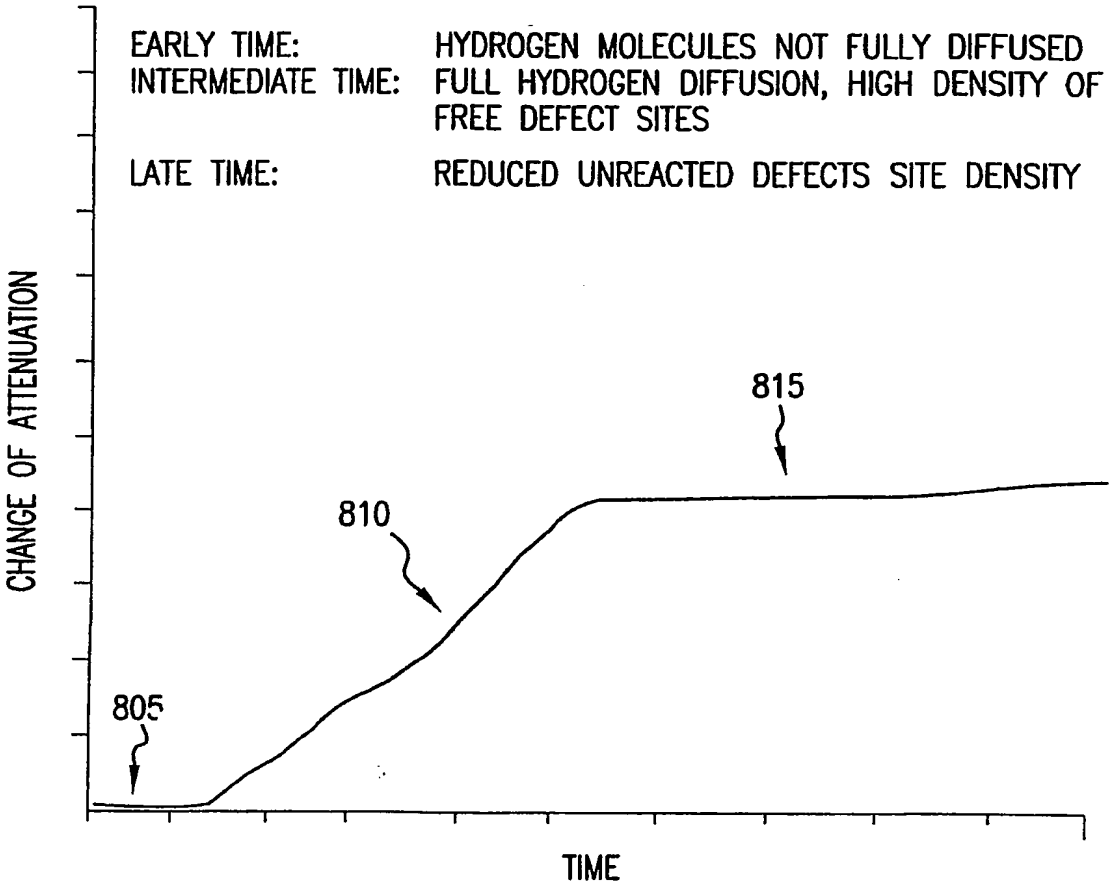

EMBED OPTICAL FIBERS IN AN EMBEDDING MATERIAL
705
SURROUND OPTICAL FIBERS AND EMBEDDING MATERIAL WITH A TUBE CONTAINMENT JACKET TO FORM A UNIT FIBER STRUCTURE (UFS)
706
SURROUND THE UNIT FIBER STRUCTURE (UFS) WITH ONE OR MORE STRENGTHENING WIRES OR STRANDS AND A FILL MATERIAL
707
SURROUND THE UFS, THE STRENGTHENING WIRES OR STRANDS, AND THE FILL MATERIAL WITH A CONTAINMENT SHEATH OR CYLINDER
708
FORM A PROTECTIVE MATERIAL AROUND THE CONTAINMENT CYLINDER
709
710
IS CABLE TO BE AN ARMORED CABLE?
NO
713
END
YES
711
SURROUND UNARMORED CABLE WITH ARMOR WIRE OR TAPE
712
FORM A SURROUNDING JACKET AROUND THE ARMOR WIRE OR TAPE

FIG.7



SEGMENTED CURVE OF REACTIVE HYDROGEN–INDUCED ATTENUATION INCREASE IN FIBERS.

FIG.8

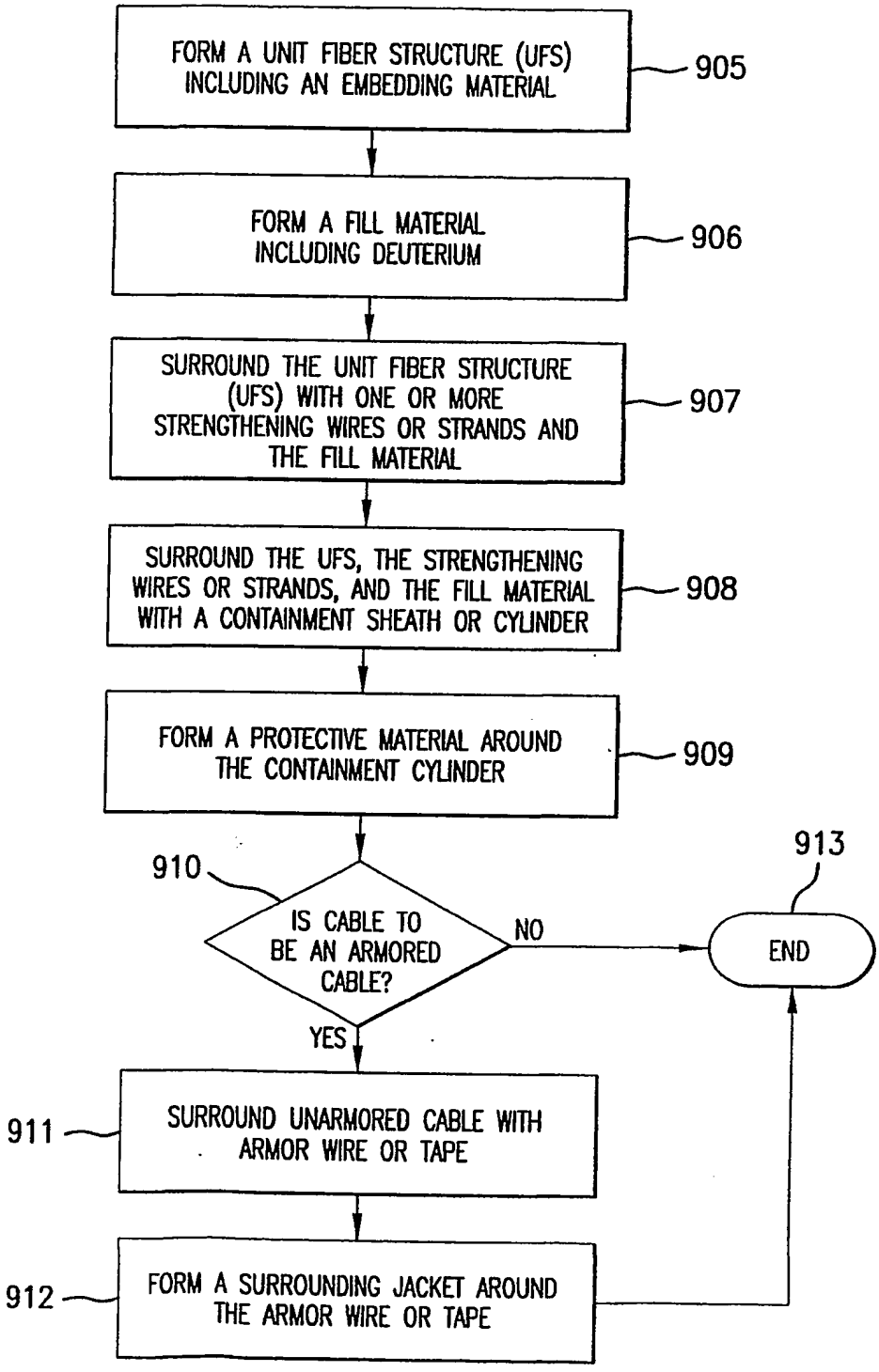

FORM A UNIT FIBER STRUCTURE (UFS) INCLUDING AN EMBEDDING MATERIAL
905
FORM A FILL MATERIAL INCLUDING DEUTERIUM
906
SURROUND THE UNIT FIBER STRUCTURE (UFS) WITH ONE OR MORE STRENGTHENING WIRES OR STRANDS AND THE FILL MATERIAL
907
SURROUND THE UFS, THE STRENGTHENING WIRES OR STRANDS, AND THE FILL MATERIAL WITH A CONTAINMENT SHEATH OR CYLINDER
908
FORM A PROTECTIVE MATERIAL AROUND THE CONTAINMENT CYLINDER
909
910
IS CABLE TO BE AN ARMORED CABLE?
NO
913
END
YES
911
SURROUND UNARMORED CABLE WITH ARMOR WIRE OR TAPE
912
FORM A SURROUNDING JACKET AROUND THE ARMOR WIRE OR TAPE

FIG.9

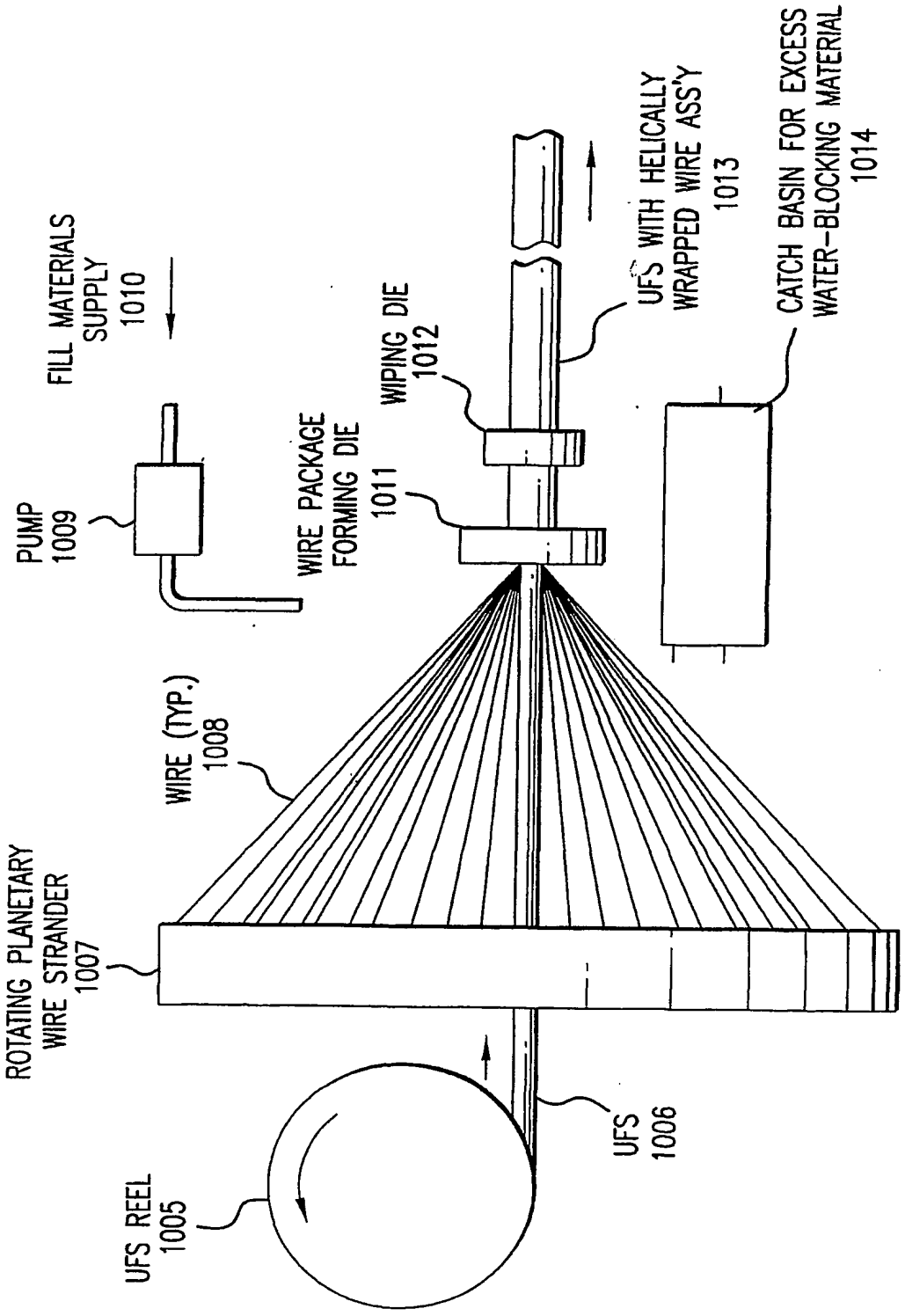
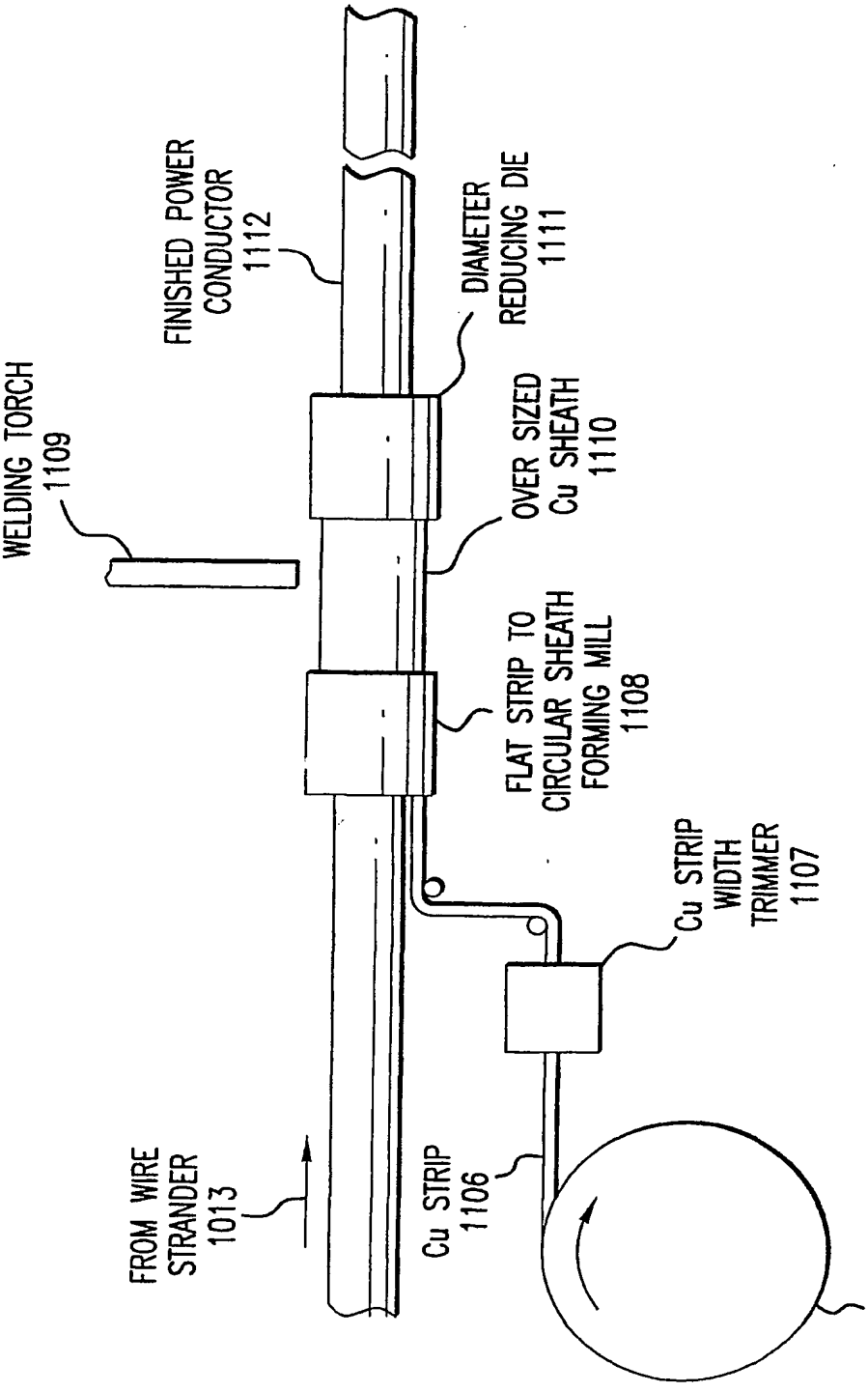

UFS REEL
1005
UFS
1006
ROTATING PLANETARY
WIRE STRANDER
1007
WIRE (TYP.)
1008
PUMP
1009
FILL MATERIALS
SUPPLY
1010
WIRE PACKAGE
FORMING DIE
1011
WIPING DIE
1012
UFS WITH HELICALLY
WRAPPED WIRE ASS'Y
1013
CATCH BASIN FOR EXCESS
WATER-BLOCKING MATERIAL
1014
CABLE WIRE STRANDING/FILL MATERIAL ASSEMBLY

FIG.10



APPLICATION OF COPPER SHEATH OVER STRANDED WIRE PACKAGE

FIG. 11

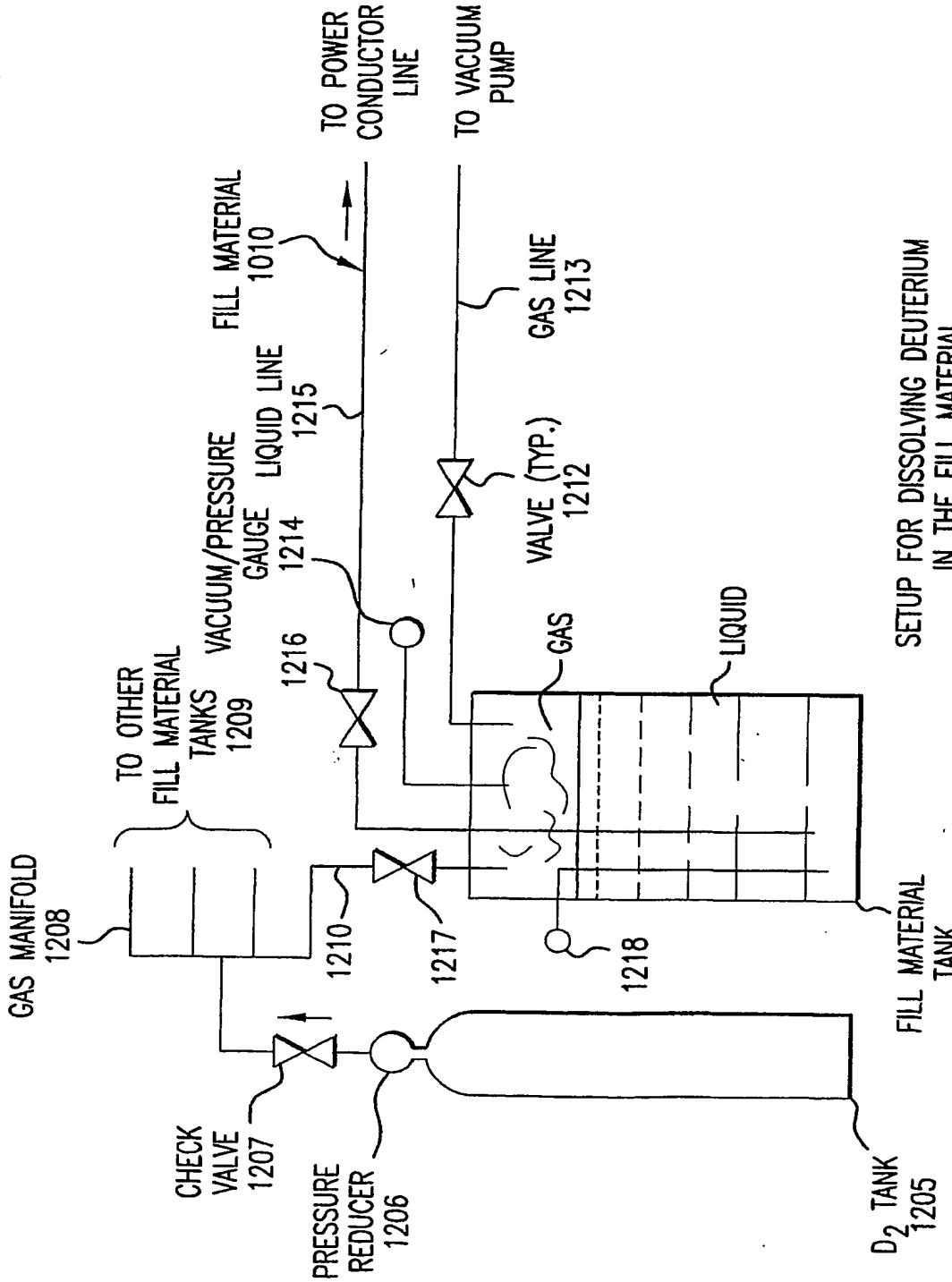


FIG.12

SETUP FOR DISSOLVING DEUTERIUM IN THE FILL MATERIAL